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PULSE PATTERN GENERATOR MG642A AND ERROR DETECTOR MS65A OPERATION CHECK MANUAL

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PULSE PATTERN GENERATOR MG642A
AND ERROR DETECTOR MS65A
OPERATION CHECK MANUAL

1. MEASURING DEVICES USED FOR OPERATION CHECK

A sampling oscilloscope is required to check the MG642A and MS65A, and trigger countdown is also to be made in order to synchronize fully with a wave for an exact observation of its form. Since the following measuring instruments are used to manufacture the MG642A and MS65A, it is recommended to use the same types of instruments for operation check.

Oscilloscope	HP180D
... Sampling Time Base & Vertical Amp	HP1811A
... Sampling Head	HP1430C
Trigger countdown	HP1104C
... T.D Mount	HP1106A

To observe an output waveform of the MG642A, it is recommended to use the UT141A semirigid cable with good frequency characteristics. The cable shall be about 50 cm long and not exceeding 1 m at the maximum.

When a signal is applied to the sampling head, be sure to insert a pad so that application of excessive overvoltage may not damage the head. Pay attention to the fact that there might be cases in which exact wave observation becomes impossible due to saturation of the head even for voltage within the safe range.

Optimum padding is 20 dB or 20 dB + 6 dB.

When there is no trigger countdown, the 1/8 Clock Sync Output

of the MG642A and the Sync Input of the Oscilloscope are connected with a BNC cable. When the Oscilloscope Sync Input has high impedance, insert a Signal Through Terminator of 50 Ω between the input and cable.

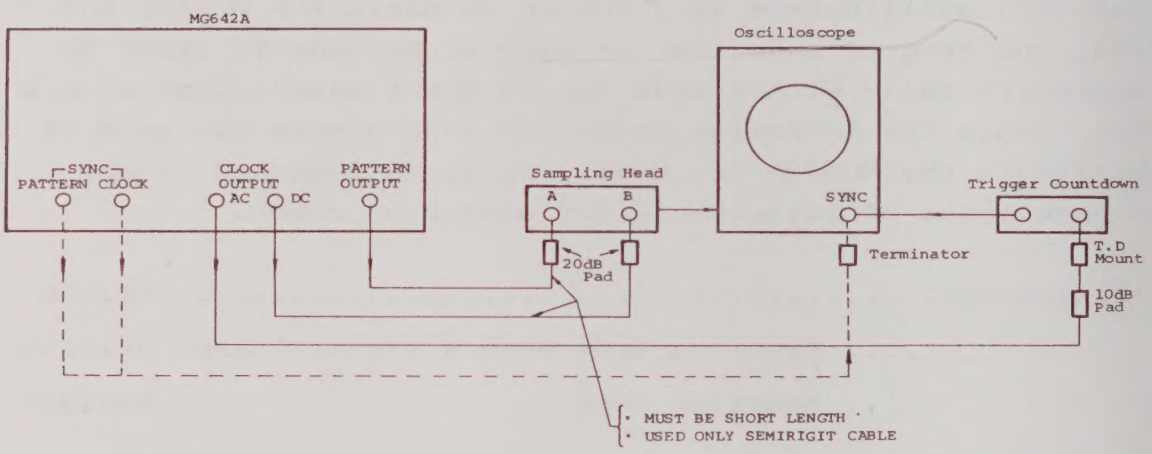

Fig. 1 TEST CIRCUIT for MG642A

2. OPERATION CHECK OF THE MG642A

2.1 Initialization of the MG642A

Initialize the MG642A according to the following procedure.

(1) Set the DELAY TIME switch at the upper right of the panel to ON and the scale of the VARIABLE to 5.00.

(2) Set the ATTENTION to 0 dB and the OFFSET to OFF.

(3) Set the POLARITY to NORMAL and the mark density of the PSEUDO RANDOM to 1/2.

(4) Set the PATTERN SELECT to PSEUDO.

(5) Set the CLOCK SELECT to INT and the INTERNAL CLOCK to 2.0 GHz range.

(6) Turn the adjusting knob of clock frequency while measuring frequency by the MS65A frequency counter so that the clock is set to 2 GHz. Without the MS65A, measure frequency with a microwave counter.

2.2 Operation of the Retiming Adjustment and Waveform Checking

(1) Set the dial of the RETIMING ADJUSTMENT to 5.00 and observe waveforms by the circuit shown in Fig. 1. Then, the waveform shown in Photo 1 will be observed on the oscilloscope. If a waveform is such one as shown in Photo 2 or Photo 3, turn the dial of the RETIMING ADJUSTMENT right or left and the waveform of Photo 1 will be observed.

(2) Turn the RETIMING ADJUSTMENT dial right to find out the point where the waveform begins to distort as shown in Photo 2, and read the dial value A at the point. Turn the same dial left in the same way and read the dial value B at the point where the waveform begins to distort as shown in Photo 3. The middle

point between A and B (call it C), that is, B + (A - B)/2 will be the optimum point of the RETIMING ADJUSTMENT. The value of (A - B) is typically 3.00 to 4.00. To evaluate a waveform and measure other circuits with the MG642A, set the RETIMING ADJUSTMENT to C-point.

(3) Add the PATTERN SYNC output signal of the MG642A to the Sync Input of the oscilloscope and observe a waveform. The waveform will be as shown in Photo 4, but a little harder to observe due to a slow sweeping of an oscilloscope. Being a part of the PN Pattern, this pattern is very long and hence will not always be observed in the same pattern sequence like the photo.

(4) When the function of the PROGRAMMABLE PATTERN is to be checked, switch the PATTERN SELECT to the PROGRAMMABLE PATTERN and set the PATTERN LENGTH to 24 bits. Then by turning on and off the PATTERN setting switches corresponding to 1 to 24 bit, check that the same sequence of pattern as that is generated. At this point, a PATTERN SYNC output signal is used for synchronization of an oscilloscope.

(5) The function of varying an offset voltage is checked. Set the PATTERN SELECT switch to PSEUDO and check if the offset voltage varies when the OFFSET SWITCH is turned ON observing the waveform shown in Fig. 1 with an oscilloscope and the variable resistor is varied. Confirm that the offset voltage does not change even if the mark density is switched over, keeping the offset voltage constant.

(6) Turn the frequency adjusting variable resistor of the MG642A so that its frequency will be 1.6 GHz, and check each item in the sequence of (1) to (4). The

same check is made with 1 GHz. When the frequency is raised from 2.0 GHz to 1 GHz. When the frequency is lowered from 1.6 GHz to 1 GHz, the RETIMING ADJUST is set in the same state as that of 2.0 GHz, and not required to be readjusted. The waveforms of 1.6 GHz and 1 GHz are shown in Photos 5 to 8.

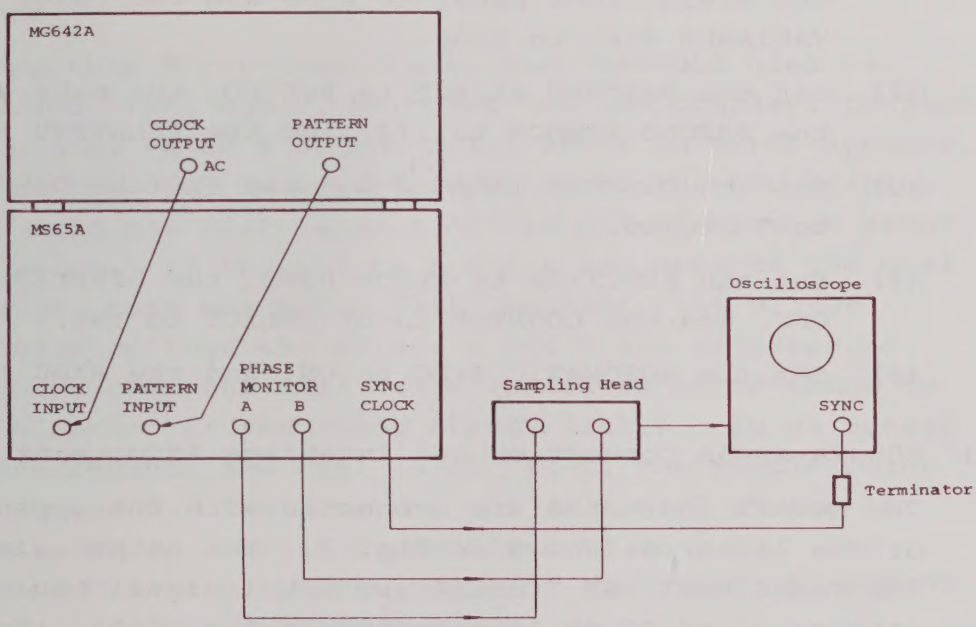

Fig. 2 Test circuit for MS65A

3. OPERATION CHECK OF MS65A

3.1 Setting of MG642A

By performing operations (1) and (2) of items 2.1 and 2.2, the MG642A is set to the best state. The setting of the output ATTENUATION is also changed to 6 dB.

3.2 Initialization of MS65A

(1) Set the PHASE ADJUSTMENT switch on the upper left of the MS65A front panel to 0 ns and the value of the VARIABLE dial to 5.00.

(2) Set the PATTERN SELECT to PSEUDO, the mark density of the PSEUDO RANDOM to 1/2, and the POLARITY to NORMAL.

(3) Set the DISPLAY TIME to 0.5 sec and the DISPLAY DIGIT to 5 Digits.

(4) Set the FUNCTION to ERROR RATE, the DISPLAY STRAG to OFF, and the COUNTER INPUT SELECT to INT.

(5) Set the AUTOMATIC SYNC to ON, and the RANG to 3-7.

3.3 MG642A-MS65A Connection and Interface Adjustment

The MG642A and MS65A are connected with the appended cable of the latter as shown in Fig. 2. The output signals of the PHASE MONITORS 1 and 2 are low in level because an attenuator of 20 dB is inserted in the MS65A. For this purpose, a sampling head can be connected directly without the attenuator.

(1) By setting the THRESHOLD LEVEL of the MS65A to 0.5 V and turning the dial gradually right, the waveform of the MONITOR OUTPUT will be as shown in Photo 9. If the dial is turned left from this point, the waveform will be as shown in Photo 10 and if further turned left, as shown in Photo 11. The THRESHOLD LEVEL is set at the middle point between the points where the waveform appears as shown in Photos 9 and 11.

Confirm in this state that the INPUT ALARM lamp is off.

(2) Here, check whether or not the SYNC FAILURE lamp goes on. If it goes on, turn gradually the ADJUSTMENT dial right or left, and the PATTERN SYNC is turned and the SYNC FAILURE lamp goes off. But the LED display counts up sequentially. If the dial is turned further, ERROR occurrence ceases to exist and the LED displays the error rate 0.0×10^{-7} in the end.

(3) From this Error-less state, the VARIABLE dial is turned right again, watching the LED display, to find the dial value A of the point where an error appears. Then the dial is turned left, watch the LED display to find the dial value B of the point where an error appears. If the points A and B are outside the dial range, turn the DELAY TIME VARIABLE dial of the MG642A so that the points A and B are adjusted to come within the dial range (where no error comes to the center of the PHASE ADJUST dial.). In an actual measurement, the dial is set at C, the middle point ot A and B. That is, $C = B + (A - B)/2$ where the value of $(A - B)$ is typically 3.00 to 4.00. The point C is the optimum point of the PHASE ADJUSTMENT.

3.4 Checking of Error Counter of MS65A

After the setting of items 3.1, 3.2 and 3.3, check whether or not the Error Counter of the MS65A is normally operating.

(1) While the pattern sync of the MS65A is turned, set the AUTOMATIC SYNC to OFF and the RANGE to 1-5.

(2) Then, confirm that the following values are displayed when the PSEUDO RANDOM switch are switched over to

0/8, 1/8, 1/4, 1/2 in this order and 8/8, 7/8, 3/4 and $\overline{1/2}$ for inverse polarity.

Mark Density	Display	Mark Density	Display
0/8	$5{,}0000 \times 10^{-1}$	8/8	5.0000×10^{-1}
1/8	$3{,}7500 \times 10^{-1}$	7/8	6.2500×10^{-1}
1/4	$2{,}5000 \times 10^{-1}$	3/4	7.5000×10^{-1}
1/2	$0{,}0000 \times 10^{-3}$	$\overline{1/2}$	Overflow

These are average values and the actual values fluctuate more or less because errors occur at random. For $\overline{1/2}$, not OVER FLOW, but 9.9 .... x 10^{-1} may be displayed.

After these checkings, POLARITY is restored to NORMAL and AUTOMATIC SYNC to ON.

(3) Set the PATTERN SELECT of the MG642A and MS65A to PROG and the PATTERN LENGTH to 24 bit, the bit sequence to bit 1, bit 3 to ligic "1", and all other bits to logic "0". If these settings are the same for both the MG642A and MS65A. The SYNC FAILURE of the MS65A turns out its lamp and the Pattern Sync is turned. Then, if the AUTOMATIC SYNC of the MS65A is set to OFF and the 2nd bit of the MS65A to logic "1", the error rate becomes 4.1700×10^{-2}. This is because an error occurs 1 bit every 24 bits. In the same way, the error rate of any bit sequence can be measured.

(4) When the corresponding frequencies, for example, 1.6 GHz and 1 GHz are used for checking, retry setting from item 3.1.

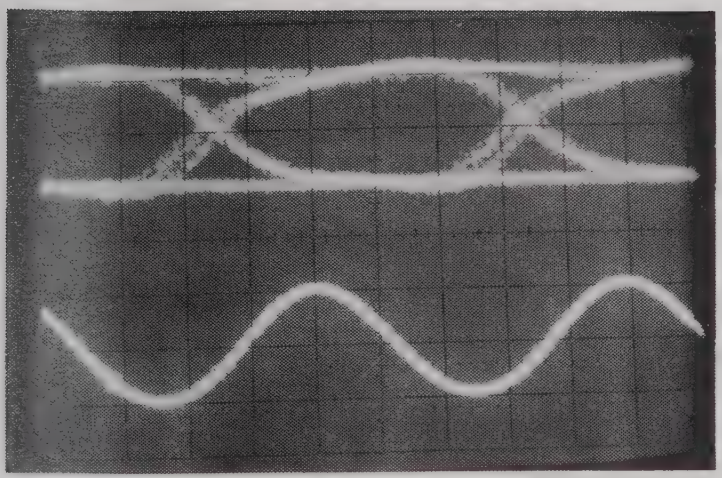

PHOTO 1

F = 2 GHz

PATTERN

CLOCK

H: 100 ps, V: 1 V

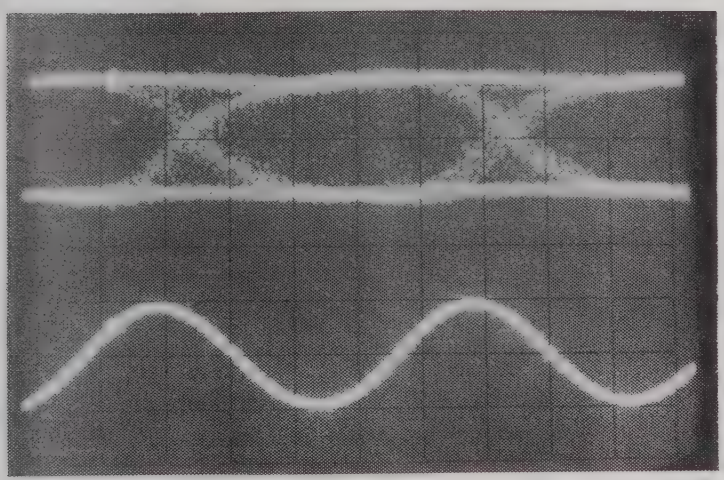

PHOTO 2

F = 2 GHz

PATTERN

CLOCK

H: 100 ps, V: 1 V

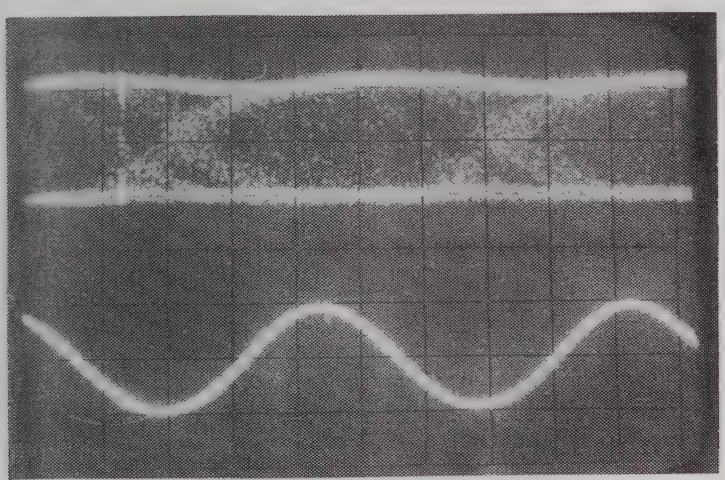

PHOTO 3

F = 2 GHz

PATTERN

CLOCK

H: 100 ps, V: 1 V

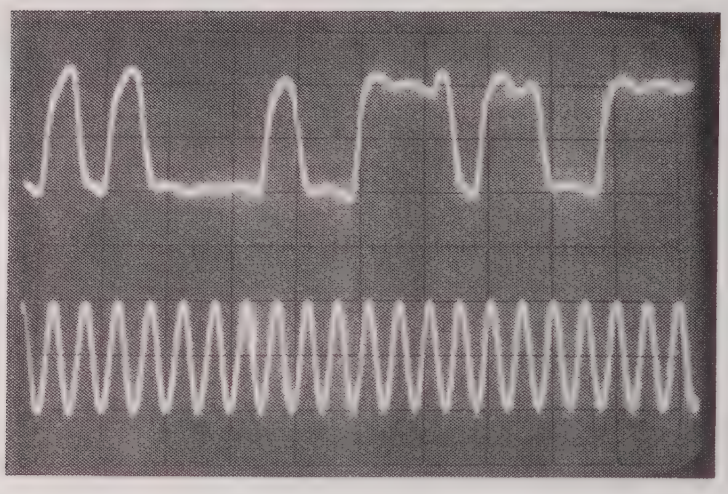

PHOTO 4

F = 2 GHz

PATTERN

CLOCK

H: 1 ns, V: 1 V

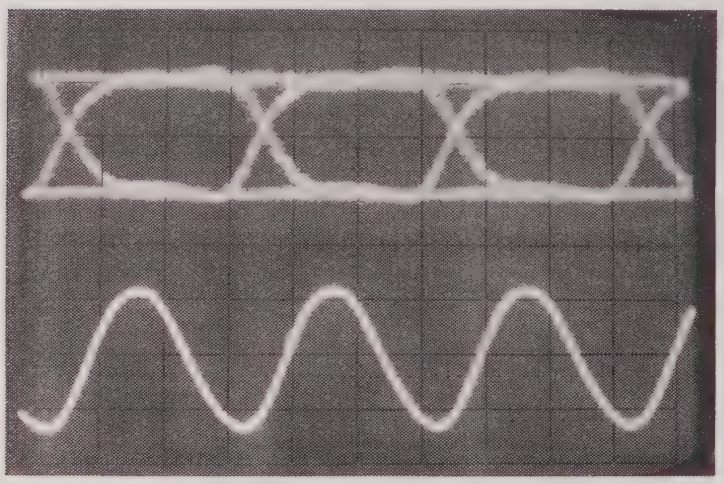

PHOTO 5

F = 1.6 GHz

PATTERN

CLOCK

H: 200 ps, V: 1 V

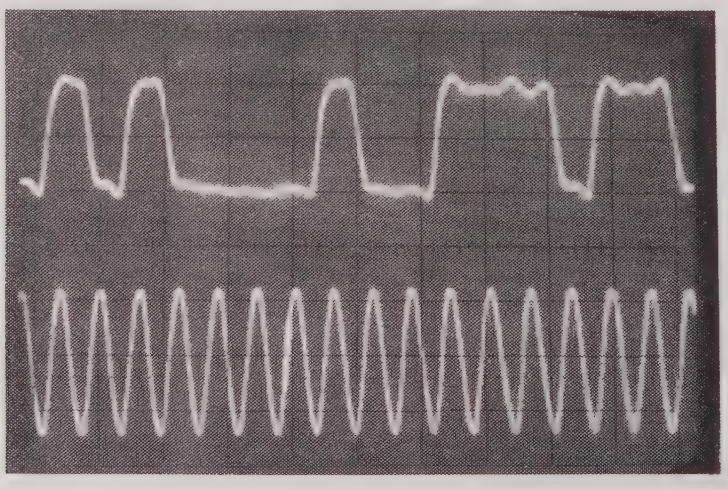

PHOTO 6

F = 1.6 GHz

PATTERN

CLOCK

H: 1 ns, V: 1 V

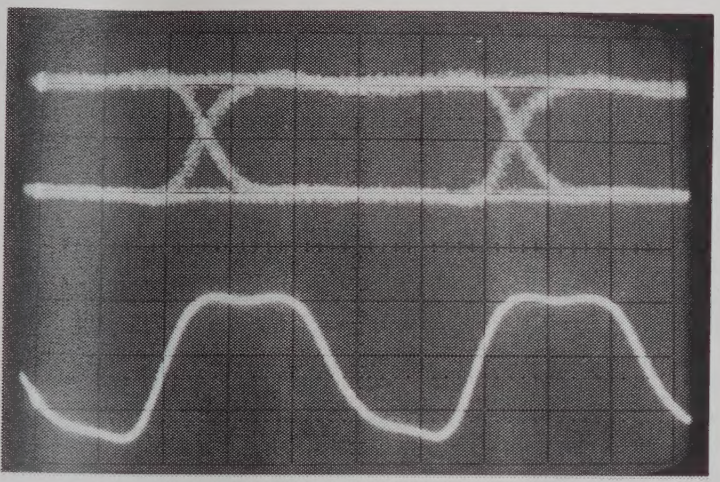

PHOTO 7

F = 1 GHz

PATTERN

CLOCK

H: 200 ps, V: 1 V

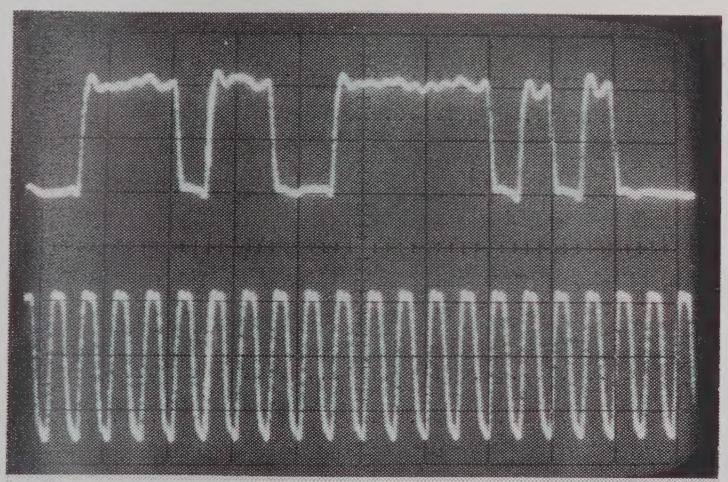

PHOTO 8

F = 1 GHz

PATTERN

CLOCK

H: 2 ns, V: 1 V

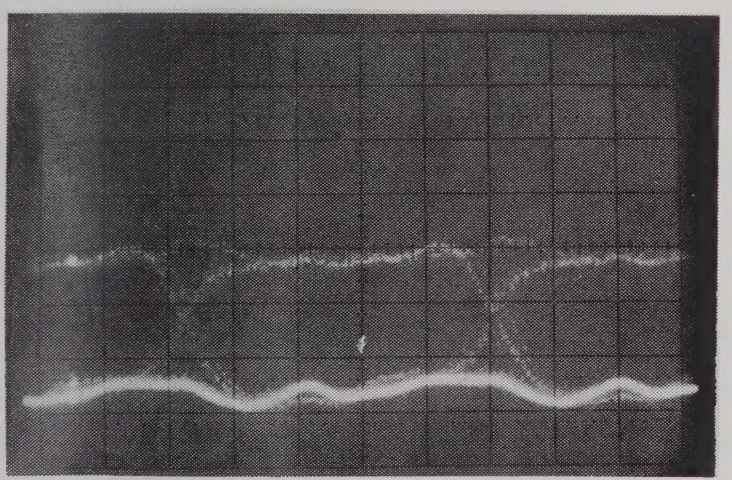

PHOTO 9

F = 2 GHz

PATTERN

CLOCK

H: 200 ps, V: 0.05 V

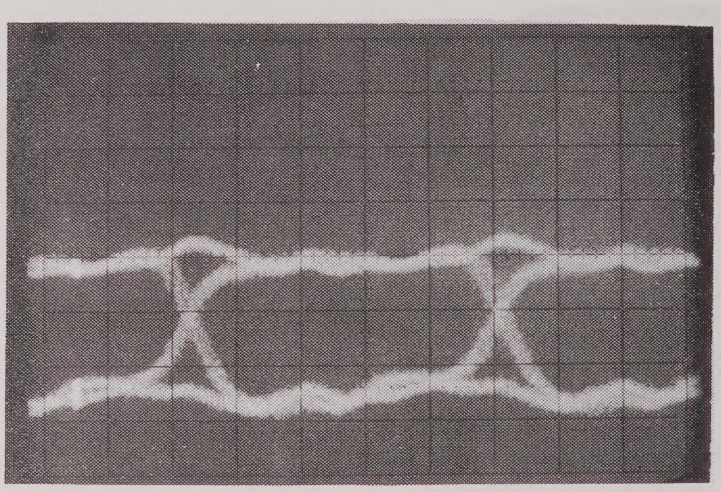

PHOTO 10

F = 2 GHz

PATTERN

CLOCK

H: 200 ps, V: 0.05 V

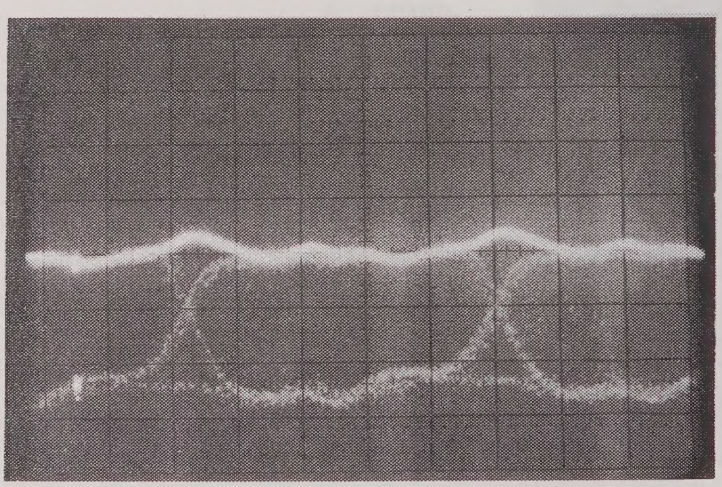

PHOTO 11

F = 2 GHz

PATTERN

CLOCK

H: 200 ps, V: 0.05 V

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